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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/036,105	10/17/2001	Roger L. Schultz	SC-01-05	4527

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EXAMINER

JONES, ROBERT D

ART UNIT

PAPER NUMBER

3672

DATE MAILED: 11/20/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Applicant N .

10/036,105

Applicant(s)

SCHULTZ ET AL.

Examiner

Robert D. Jones

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 October 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 April 2002 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

Title

1. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: Method and Apparatus for Monitoring the Condition of a Downhole Drill Bit, and Communicating the Condition to the Surface.

Abstract

2. The abstract of the disclosure is objected to because of the language "is described" in the first sentence. The abstract should avoid using phrases that can be implied.

Correction is required. See MPEP § 608.01(b).

Specification

3. The attempt to incorporate subject matter into this application by reference to the patent applications listed on page 1, lines 8-12 is improper, because the U.S. Patent application numbers have been omitted. Appropriate correction is required.
4. The disclosure is objected to because of the following informalities: Page 23, line 19 has a typographical error; "exceed" should be changed to --exceeded--.

Page 46, line 21, "vlavle" should be changed to --valve--.

Appropriate correction is required.

Drawings

5. The drawings are objected to because view designations are missing from Figures 21, 27, and 31. In Figures 21, 27, and 31, the two views on the left side of the page are designated "A" and "C", however, letters designating views on the right had side (most likely B and D) have been omitted. Proposed drawing correction or corrected drawings are required in reply to the

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Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

6. The drawings are objected to in accordance with 37 CFR 1.84(u) because Figure 16 discloses a front view, and a sectional view of the apparatus in the same figure. The sectional view and the front view should be designated with separate view numbers; for example, the front view should be designated 16A, and the sectional view designated 16B. Also, sectional lines A-A should be changed to Roman or Arabic numerals, see 37 CFR 1.84(h)(3). The objection to the drawings will not be held in abeyance. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

7. The drawings are objected to because the graph in Figure 51 has no reference characters or scale indications, and no indication of what the figure intends to disclose. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application.

8. The drawings are objected to because two separate drawings have been designated as Figure 53, and there is no Figure 54. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

9. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the mechanism enabling the "irreversible" movement of the valve specifically claimed in claims 6-9, and 15, must be shown or the feature(s) canceled from the claim(s). Although a schematic view of the valve is shown in

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Figure 47, there is insufficient detail in the drawing to indicate that the movement of the valve is "irreversible." Although a valve with an "irreversible movement" is specifically claimed, there is nothing shown in the drawings to indicate that the valve is structurally any different from a "reversible" sleeve valve. Page 44 of the specification indicates that, at some point, the valve is "permanently" closed, however, there is nothing in the drawing (or the specification) that structurally differentiates the valve from a sleeve valve that is simply closed and not reopened. For example, there is no locking mechanism, or modified locking mechanism disclosed.

Claim 6 indicates that the valve is moved "irreversibly into at least one intermediate state." No intermediate state is disclosed, and from Figure 47, it is not clear what an irreversible move into an intermediate state would be. Similarly, claim 8 specifically indicates that the valve moves at a time constant of about one second, but no pulsing type apparatus or enabling mechanism is disclosed.

No new matter should be entered.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

10. The drawings are objected to because Figure 47 lacks the proper crosshatching as required by MPEP § 608.02(a). In a cross sectional drawing, cross sections of solid materials (like bit subs) must be shown with the appropriate crosshatching. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

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11. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

12. Claims 4, 6-9 and 15 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

13. In claim 4, it is unclear if the "warning states" described in the claim are "independently derived" from completely independent sensors, or if one set of sensors are commonly monitored and the data is processed by three independent methods, which result in, for example, a warning from one data analysis method, but not the other two, or if "independently derived" refers to some other means that would indicate a "warning state."

It is also unclear whether the "failure conditions" indicated in the claim refer to a failure of the sensors, a failure of sensor information processing, a failure of the bit, or some general failure that may or may not include the bit and associated monitoring hardware and processes. It is similarly unclear why the "failure condition" would "preclude detection of a "first warning state" either from individual sensor failures, or from data analysis method failures, or both, or another means that may or may not be associated with the bit and downhole sensors.

Although the first paragraph at the top of page 44 of the disclosure briefly and broadly addresses the concept of "combining two schemes to give warnings at different times," there is not sufficient detail in the description to enable a person skilled in the art, as specifically applied to the disclosed invention.

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14. Claim 6 describes the "irreversible" movement of a valve through a series of states, and then back to its original state. The use of the term "irreversible" in this context is confusing, and possibly contradictory. Claim 8 indicates that the irreversible valve movement (opening and closing?) occurs at a time constant of at least about one second. It is unclear how an "irreversible valve" could be repeatedly opened and closed. Although Applicant briefly addresses irreversible valves on page 44 of the specification, the explanation given is inconsistent with the valve movement described in dependent claim 8. Claim 8 also appears to have no specific antecedent basis in the specification. Claims 7 and 9 are also objected to because they are dependent on claim 6. Claim 15 also refers to the "irreversible" movement of a valve, and as a result, is also not enabling.

Claim Rejections - 35 USC § 102

15. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

16. Claims 1-5, and 14-17 are rejected under 35 U.S.C. 102(b) as being unpatentable over U.S. Patent 5,415,030 to Jogi.

17. With regard to claim 1, in Figure 1 Jogi discloses a system for monitoring drill bit performance comprising a sensor tool 16 located on a downhole section of the drill string with a plurality of sensors and circuitry for processing the states of the sensors. As indicated in Figure 2, numerous logs are generated which directly and indirectly track the condition of the bit from the time it is originally run in the hole, to indications that the bit is beginning to fail, to final

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failure of the bit. The bit tracking logs include the Drilling Response Log, the Bearing Wear Log, the Torque Analysis Log, and the Bit Wear Factor Log. Specifically, the Bit Wear Factor Log expresses the condition of the bit on a scale of zero to one. By monitoring the applicable logs, an operator of ordinary skill in the art would easily detect when the failure of a bit is beginning ("first warning"), and when final failure of the bit is at hand ("second warning"). Therefore, Jogi describes a system for monitoring drill bit performance, comprising: a plurality of sensors located on a downhole section of the drill string; and circuitry for processing the states of said sensors to thereby derive a first warning state when the sensors indicate that failure of the bit is beginning, and a second warning state when the sensors indicate that a final failure is at hand.

With regard to claims 2 and 3, column 4, lines 18-23 indicate that the output of sensor tool 16 is fed to a transmitter 18 which communicates to the surface via a mud pulse telemetry system. It is well known in the art that a mud pulse is a variation in drilling fluid pressure caused by the movement of a valve located in the drill string. The bit condition tracking logs listed supra provide progressive indications of when and if a bit is beginning to fail ("first warning") and when a final failure occurs ("second warning"). The logs are visible to the operator at the surface, and are communicated to the surface by the mud pulse telemetry process. Therefore, Jogi describes a system wherein a first warning state is indicated to the surface operator by a variation of drilling fluid pressure (mud pulse) caused by the movement of a valve in the drill string. A second warning is also communicated to the operator by varying the position of a valve in the drill string (via additional mud pulses).

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With regard to claim 4, first and second warnings may be derived independently from any one of the bit condition tracking logs mentioned supra. As indicated in Figure 2, multiple independent inputs are used to generate the logs/warning indications, and as a result, these independent inputs allow for conditions wherein a second warning state can be detected by sensors and circuitry even under some failure conditions that would preclude detection of the first warning state. For example, a premature bearing failure may result in an increase in torque at the bit, however, the bearing failure torque increase may be mask on the Bit Wear Log by a change in the formation penetrated i.e. the entry into a significantly softer formation. However, the Torque Analysis Log, which factors in, among other things, lithology, and plots expected torque versus actual torque, should sense the higher than expected torque and notify the operator. More broadly, a sustained rate of penetration of zero or near zero, as sensed by the operator, will alert the operator ("second warning") that a failure in the system has occurred, regardless of the absence of a "first warning."

With respect to claim 5, column 2, lines 25-30 indicate that sensors near the bit monitor torque (first type of sensor) and downhole weight on bit (second type of sensor). Figure 2 indicates that revolutions per minute, rate of penetration, lithology (via a gamma ray tool), mud pressure, and directional data are also monitored.

With respect to claim 14, in column 4, lines 15-25, Jogi discloses a method of operating a drilling rig comprising the step of signaling a change in downhole equipment condition by causing a variation in drilling fluid static pressure (via mud pulses).

With respect to claim 15, it is well known in the art that a mud pulse is a variation in drilling fluid pressure caused by the movement of a valve located in the drill string.

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With respect to claim 16, a mud pulse is created by cycling a valve from a position which restricts fluid flow, and through a position which restores fluid flow to its normal state.

With respect to claim 17, in Figure 1 Jogi discloses a sensor tool 16 located on a downhole section of the drill string comprising a plurality of sensors and circuitry for processing the states of the sensors. The sensor tool 16 is attached to a transmitter tool 18 that communicates the data to the surface.

18. Claims 10 and 12 are rejected under 35 U.S.C. 102(b) as being unpatentable over U.S. Patent 3,626,482 to Quichaud.

Column 9, lines 1-20, of Quichaud disclose a method of operating a drilling rig that comprises monitoring downhole mud flow impedance to ascertain information regarding the vibratory state of the downhole drilling equipment. In Figure 8, Quichaud discloses a mud pulse telemetry system that includes a valve 117 that changes position according to readings of one or more sensors located on a downhole sub assembly, and communicates the vibratory state of the drilling gear to the surface via mud pulse telemetry. Column 9, lines 40-45 specifically indicates that the apparatus is used measure torsional and longitudinal vibrations. If the vibratory state of the drilling gear becomes extreme and indicates a failure or an impending failure, the condition would be communicated to the surface by mud pulses (mud impedance) and an operator of ordinary skill in the art, would halt drilling operations and determine the cause. Therefore, with respect to claim 10, Quichaud describes a method of operating a drilling rig comprising the steps of: monitoring downhole mud flow impedance; halting drilling when the impedance is altered by a downhole valve which opens or closes a shunt path for mud flow; wherein said valve changes position according to readings of one or more sensors located on a downhole sub assembly.

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With respect to claim 12, Figure 8, and column 9, lines 40-45 specifically indicate that the apparatus described in Quichaud measures vibrational frequency.

Claim Rejections - 35 USC § 103

19. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

20. Claims 6-10, 13, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jogi in view of U.S. Patent 3,982,431 to Grosso.

21. Jogi discloses a bit wear monitoring system that communicates downhole sensor readings to the surface via mud pulses, however, Jogi does not specifically disclose the valve apparatus for transmitting the pulses, or the use of an adaptive filter. In Figure 2, and in column 4, Grosso discloses a method and apparatus for transmitting mud pulses through the use of a valve apparatus. In Figure 5A and column 7, Grosso discloses an adaptive filter mechanism. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to add the transmitting tool disclosed in Grosso to the system disclosed by Jogi. One would have been motivated to make the modification because in column 4 lines 20-25, Jogi indicates that Grosso has been incorporated into the Jogi invention by reference.

With regard to claim 6, in Grosso Figure 2 and in Grosso column 4, Grosso discloses a method and apparatus for generating mud pulses to communicate bore hole sensor readings regarding (among other things) the condition of the bit to the surface. The apparatus includes drill string segment 26 which houses a transmitter valve assembly 50, 56. The valve assembly is

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comprised of a variable orifice 50, and a valve plunger 56. The mud flow pulse (impedance) is varied by opening and closing the seat orifice 50 with the plunger 56. The valve 50, 56, is opened and closed as required to create a mud pulse telemetry system, with the valve 50, 56 eventually returning to the open position during normal drilling. The telemetry system functions to communicate drill bit conditions, including failure information, to the surface. Therefore, Grosso describes a downhole assembly which indicates a failure condition by the movement of a valve which affects mud flow impedance from a first state which is initially present during normal drilling conditions, to intermediate states which may indicate failures and warnings, and (if elected) into a "final" state which returns mud flow to substantially that seen in normal drilling conditions. (Note: because of the indefinite use of the term "irreversible" as noted in items 10 and 15 supra, the limitation has been construed extremely broadly in the consideration of claims 6-9, similarly, the term "intermediate state" has also been construed broadly because of a lack of specific definition.)

With respect to claim 7, Grosso Figures 3 and 4 show sensors located on the downhole assembly 26 that monitor parameters indicative of drill bit 14 conditions.

With respect to claim 8, there is no indication in the specification that the one second time constant claimed is material to the invention, therefore, the frequency of the time constant appears to be a design choice. The frequency time constant of the valve disclosed by Grosso is programmed by the operator and is not subject to structural limitations that would preclude a one second time constant, therefore, a time constant of about one second is anticipated by the mechanism and method described in Grosso.

With respect to claim 9, Grosso indicates that mud flow impedance is varied by opening an aperture (valve 50, 56) which allows mud to flow from the interior of the drill string to the bore hole.

With respect to claim 10, Grosso discloses a system of operating a drilling rig comprising the steps of monitoring downhole mud flow impedance; halting drilling when said impedance is altered by a downhole valve 50, 56, which opens or closes a shunt path for mud flow (i.e. creates a mud pulse that indicates to an operator via surface monitoring equipment disclosed in Jogi, that a failure has occurred); wherein said valve 50, 56, changes positions (opens and closes) according to readings of one or more sensors located on a downhole sub assembly 26.

With respect to claims 13 and 18, an "adaptive filter" is an extremely broad limitation. In Figure 5A and column 7, Grosso discloses a filter 74 which receives input from downhole sensors. The filter 74 analyzes the input and adapts the information for digital mud pulse communication to the surface.

22. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jogi in view of Grosso, as applied to claim 10, in further view of U.S. Patent 4,821,563 to Maron.

Jogi, as modified by Grasso, describes the invention essentially as claimed, however, Jogi, as modified by Grasso, does not specifically describe axial strain measurement. In Figures 4-6, and 8, and column 5, lines 10-56, Maron describes a method and apparatus of measuring axial strain in the context of a bit wear monitoring system. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to add the sensor tool disclosed in Maron to the system disclosed by Jogi in view of Grosso. One would have been

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motivated to make the modification because in column 4 lines 10-25, Jogi indicates that Grasso and Maron have been incorporated into Jogi by reference.


23. Prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Prior art includes U.S. Patent 6,021,377 to Dubinsky and U.S. Patent to 4,928,521 to Jardine, teaching drilling and drill bit monitoring systems.

24. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Robert D. Jones whose telephone number is 703-305-6296. The examiner can normally be reached on 8:30AM - 7 PM Monday through Thursday..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Bagnell can be reached on 308-2151. The fax phone numbers for the organization where this application or proceeding is assigned are 703-305-7687 for regular communications and 703-305-3597 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-306-4180.

rdj
November 18, 2002


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